Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of:	)	
	)	
Unlicensed Use of the 6 GHz Band	)	ET Docket No. 18-295
	)	
Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz	)	GN Docket No. 17-183
	)	

COMMENTS OF
THE NATIONAL ASSOCIATION OF BROADCASTERS

February 15, 2019

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COMMENTS OF THE NATIONAL ASSOCIATION OF BROADCASTERS

I. INTRODUCTION AND SUMMARY

The National Association of Broadcasters (NAB)[1] submits the following comments in response to the Commission's Notice of Proposed Rulemaking concerning unlicensed operations in the 6 GHz band.[2] NAB supports the Commission's efforts to expand opportunities for spectrum use, including expanded opportunities for unlicensed use of the 6 GHz band. At the same time, broadcasters rely on important broadcast auxiliary services (BAS) operations in the 6425-6525 MHz (U-NII-6) and 6875-7125 MHz (U-NII-8) to cover major events.[3] There are no ready substitutes available for this spectrum. Further, the

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[1] The National Association of Broadcasters (NAB) is the nonprofit trade association that advocates on behalf of free local radio and television stations and broadcast networks before Congress, the Federal Communications Commission and other federal agencies, and the courts.

[2] *Unlicensed Use of the 6 GHz Band; Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, Notice of Proposed Rulemaking, ET Docket No. 18-295, GN Docket No. 17-183, FCC 18-147 (Oct. 24, 2018) (NPRM).

[3] The mobile use of 6875-7125 MHz (U-NII-8) is limited to certain geographic areas. *Amendment of Part 101 of the Commission's Rules to Facilitate the Use of Microwave for Wireless Backhaul and Other Uses and to Provide Additional Flexibility to Broadcast Auxiliary Service and Operational Fixed Microwave Licensees*, Report and Order, Further Notice of

proposals the Commission sets forth to protect these broadcast operations, such as limiting unlicensed use to low-power, indoor operation, will not protect these operations and will result in harmful interference. Mobile and low-power BAS operations in these bands will be particularly vulnerable to interference from unlicensed users.

Accordingly, NAB urges the Commission not to permit unlicensed operations in the U-NII-6 and U-NII-8 bands unless a robust, reliable mechanism is developed to coordinate these operations with licensed BAS uses – including mobile uses. The Commission can still consider making hundreds of megahertz of spectrum available for unlicensed operations in the U-NII-5 and U-NII-7 bands while preserving important broadcast operations in the U-NII-6 and U-NII-8 bands that consumers rely on today. If technical solutions develop that can reliably protect operations in the U-NII-6 and U-NII-8 bands, the Commission can consider additional unlicensed opportunities in those bands at a later date and in a separate proceeding.

II. THE U-NII-6 AND U-NII-8 BANDS ARE VITAL FOR BROADCAST OPERATIONS

As the Commission correctly notes, unlicensed Wi-Fi uses have become ubiquitous in homes, businesses and public venues, including in ballparks and stadiums, where Wi-Fi access has become almost expected.[4] Of course, television viewers have also come to expect the superior coverage and storytelling enabled by wireless technology in covering major events in many of the same public venues.

Much of the coverage viewers enjoy today of sporting events, breaking news and special event coverage relies on broadcast use of the U-NII-6 and U-NII-8 bands. Broadcasters and other programmers use low-power transmitters on portable cameras to contribute audio

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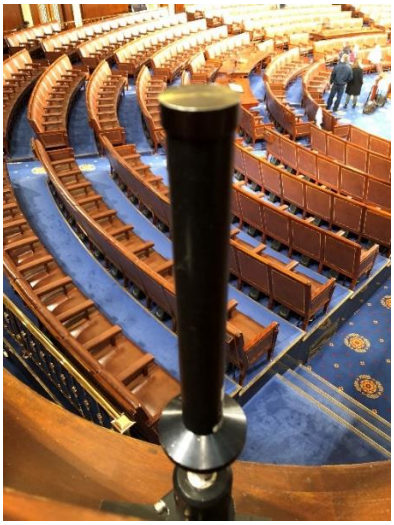
Proposed Rulemaking, and Memorandum Opinion and Order, Attachment A, 26 FCC Rcd 11614 (2011).

[4] NPRM at ¶ 5.

and video coverage to networks and stations. When viewers watch courtside player interviews, court-level game coverage or interviews with policy makers or public safety officials during breaking news or special events, such as political conventions, they are relying on spectrum in the U-NII-6 and U-NII-8 bands. These indoor operations are low-power, and receive antennas have no protection from harmful interference from nearby transmitters operating on the same frequency.

A sample camera-back transmitter is shown below:

Similarly, the antenna shown below is the receive antenna used to capture video from the floor during the 2019 State of the Union address:



An omni-directional receive antenna like this one obviously has no protection from co-channel operations in the same venue. All signals, whether desired or undesired, will be received equally by this antenna.

Broadcasters also use television pick-up stations to transmit coverage from special events or remote locations back to a studio or central receive site. Further, the Commission recently authorized low-power auxiliary stations (LPAS), including wireless microphones, in the U-NII-8 band and this band is expected to become more important as the VHF and UHF broadcast spectrum becomes less viable for LPAS operations due to repacking of primary and secondary broadcast stations.[5] There is no ready substitute for this spectrum; other bands available for wireless microphones are already heavily encumbered or require advanced coordination which is impractical for breaking news coverage.

Broadcast use of this spectrum is significantly more intense than the NPRM appears to recognize. While the NPRM notes that the Commission's assignment database shows fewer than one thousand callsigns in each of these bands, the number of transmitters in use is many times that figure for two reasons.[6] First, a single callsign is typically associated with multiple transmitters. Second, broadcasters often operate broadcast auxiliary service transmitters pursuant to the short-term operation provisions of the Commission's rules which do not require a part 74 license.[7]

For these reasons, any proposal to allow unlicensed operations in the U-NII-6 and U-NII-8 bands must provide a reliable, technically sound mechanism for preventing potential

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[5] NPRM at ¶ 10.

[6] *Id.* at ¶ 8.

[7] 47 CFR §74.24.

harmful interference that will disrupt coverage of viewers' favorite events. Unfortunately, the NPRM and the record of this proceeding to date do not set forth any such mechanism.

A. The RKF Study Is Fatally Flawed

A group of companies supporting unlicensed operations in the 6 GHz band submitted a technical study (the RKF Study) purporting to demonstrate that unlicensed operations in the band could coexist with a multitude of other uses without causing interference.[8] As described in detail below, this study reflects numerous flaws and the Commission should not rely on it.

Most problematically, the study is based on a flawed statistical analysis using a variety of questionable assumptions. For example, the study relies on average values for many parameters, much like the statistician who drowns crossing a river with an average depth of two feet. Relying only on averages ignores many "worst-case" scenarios that are actually quite common, such as unlicensed devices operating at heights above 28.5 meters,[9] or the lack of building penetration losses for devices operating near windows.[10] The study also conflates low duty cycle operation with short-term interference,[11] and ignores the potential for indoor BAS operations, including in high-rise buildings, as well as other common broadcast uses, including wireless microphones and camera-back transmitters used to relay video and audio content.

The study relies on a Monte Carlo simulation of randomly-placed electronic news gathering (ENG) transmitters and concludes that up to 69.3 percent of ENG "links do not

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[8] Letter from Paul Margie to Marlene Dortch, DN Docket No. 17-183, Attachment (Jan. 26, 2018).

[9] *Id.*, Attachment at 25.

[10] *Id.*, Attachment at 33.

[11] *Id.*, Attachment at 29.

close even without [Radio Local Access Network] interference."[12] Monte Carlo simulations rely on random sampling to develop results, which may be appropriate in interference studies where transmitters are likely to be randomly placed. However, many ENG transmitters are not randomly sited. Although breaking news events may occur at obscure locations, many scheduled and unscheduled events take place at known locations, such as sports venues, or courthouses and other government buildings, where experienced ENG crews deploy trucks at particular locations where they know the ENG link will function properly. Even when dispatched to an unknown or random location, the ENG crew will move the truck as needed to close the link. Monte Carlo simulations thus grossly and incorrectly minimize the impact of interference in this case. While the authors suggest that they account for this by discarding locations where the ENG link did not close under assumed conditions, there is no basis for the study's assertion that the statistical results would be unchanged.[13]

In general, the RKF study authors do not show the calculations and assumptions underlying their conclusions. For example, the apparent use of an assumed elevation plane antenna pattern for U-NII devices is not described and there is not a single example of a link margin calculation to illustrate the study's methodology. The study mixes receive antenna heights above ground level and above average terrain and fails to explain how the assumed heights are calculated or used in its simulations. NAB has raised these issues with RKF and its sponsors, but we have not received satisfactory answers.

The RKF study also assumes a maximum average duty cycle for unlicensed devices of 0.44 percent. This is a meaningless figure. There is a huge difference in interference potential

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[12] *Id.*, Attachment at 60.

[13] *Id.*, Attachment at 57.

between a device that transmits for 15.8 seconds and is then silent for 59 minutes and 44 seconds and a device that transmits for 50 milliseconds every 11.4 seconds. Both of these devices have a duty cycle of 0.44 percent on an hourly basis, but while a programmer could conceivably work around a 15.8 second blast of interference every hour, an intermittent transmission with the same duty cycle could completely block a channel from effective use.

Further, this 0.44 percent duty cycle is for a single device, which means that 225 additional devices could transmit at different intervals during peak periods while each maintains a duty cycle of 0.44 percent. Because Wi-Fi use may be particularly high during special events, sports or breaking news where BAS operations rely on access to the U-NII-6 and U-NII-8 bands, the assumption of an artificially low duty cycle does not mitigate interference concerns.

The study also relies on assumptions that clutter will attenuate unlicensed signals and help protect licensed operations. Clutter in these situations is generally unknown and can be highly variable. Standard practice, and the recommendation of the International Telecommunications Union, is not to rely on clutter where it is unknown.[14] ITU recommendations also caution that, "care should be taken not to expect high clutter losses in a high-rise urban area consisting of isolated tall buildings separated by open spaces."[15] Yet this situation precisely describes many television pickup operations on which programmers rely to transmit programming from the location of a special event or breaking news story to a

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[14] International Telecommunications Union, Recommendation ITU-R P. 452-16, "Prediction procedure for the evaluation of interference between stations on the surface of the Earth at frequencies above about 0.1 GHz (July 2015) at 18, available at: https://www.itu.int/dms_pubrec/itu-r/rec/p/R-REC-P.452-16-201507-I!!PDF-E.pdf ("Where there are doubts as to the certainty of the clutter environment, this additional loss should not be included.")

[15] *Id.*

central receive site or studio. In short, any serious review of the RKF Study confirms that it provides no basis for assumptions concerning the likelihood of interference to licensed BAS operations in the U-NII-6 and U-NII-8 bands.

B. The Hidden Node Problem Significantly Complicates Potential Unlicensed Operations in the U-NII-6 and U-NII-8 Bands

Any sharing regime must recognize and deal with the "hidden node" problem. Hidden nodes arise when, for example, passive receivers cannot be detected or protected by other spectrum users. One-way transmission systems are particularly subject to hidden node interference because the locations and characteristics of the receivers are typically not known. For example, with respect to broadcast television and radio, no one knows where all television sets or radio receivers are located, whether they are on or off or to what channel they are tuned, and it would be impractical and unreasonable to try to collect this information. The only way to protect these receivers is by excluding access within the entire geographic area served by the broadcaster.

Similarly, the hidden node problem is significant for BAS operations because many of them are one-way. The receive nodes cannot be sensed. Further, particularly for temporary and itinerant operations, the locations are not contained in any database. The only way to protect such hidden nodes is to exclude unlicensed operations from the spectrum used by BAS for mobile operations.

As a result, NAB agrees with the NPRM that the automated frequency coordination (AFC) system and other mitigation options proposed in the RKF study would not be feasible or adequate in the bands and locations where BAS mobile operations are authorized. Unless some automated means for receivers to communicate their location and status to a central authority develops, or low-level sensing approaches become a demonstrably reliable technology to prevent interference, standards for spectrum-sharing must respect the

geographic boundaries of licensed users. Unfortunately, as discussed in more detail below, the Commission's alternative proposals will also fail to protect licensed BAS operations.

III. THE NRPM'S PROPOSALS WILL NOT PROTECT BAS OPERATIONS

A. Indoor and Low-Power Restrictions Are Inadequate

While the NPRM recognizes that an AFC system will not successfully protect BAS operations, particularly mobile operations,[16] the alternatives set forth in the NPRM are no more likely to succeed. The NPRM proposes to restrict unlicensed operations in the U-NII-6 and U-NII-8 bands to low-power, indoor operations. However, licensed BAS operations such as camera-back transmitters used to relay video and audio content themselves frequently operate indoors and at low-power. Typical power levels for the BAS equipment presently used indoors in the U-NII-6 and U-NII-8 bands are in the range of 50-250 mW, which is comparable to or less than the power levels contemplated for unlicensed operations in those bands. Plainly, indoor BAS operations are squarely in the crosshairs for harmful interference from indoor unlicensed devices operating with similar power levels.

Moreover, limiting unlicensed operation in the U-NII-6 and U-NII-8 bands to indoor locations is unlikely to protect even outdoor BAS operations. Television pick-up stations used for ENG frequently have lengthy transmission paths, covering dozens of miles over both residential and commercial districts. Because the BAS signal will be weak at the receiver, even low-power indoor Wi-Fi operations near windows could easily cause interference to these links.

For example, demodulation of a 64 QAM HD video signal requires a receive carrier level (RCL) of about -82 dBm with no interference present. Measurements have shown that

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[16] NPRM at ¶ 61.

interference from a 3 MHz digital carrier must be suppressed so that the carrier-to-interference plus noise (C/(I+N)) margin is greater than 17 dB in order for the ENG video link to operate properly. A sample link budget demonstrates that a single WiFi device, operating indoors near a window, could cause harmful interference to a typical outdoor ENG link.[17]

50-mile ENG truck to Central Receive Site:

- 6425 MHz, 80.47 km path, FSPL = 146.77 dB
- TPO = 1 watt, G_{txant} = 30 dBi
- G_{rxant} = 36 dBi, 6 dB line loss
- RCL = -56.77 dBm

The resulting signal level is about 25 dB above the required -82 dBm threshold necessary for successful signal recovery. Introducing a noise-like interfering signal from a hypothetical U-NII device two miles from the ENG receiver eliminates substantially all of the available margin and will result in massive interference:

2-mile U-NII device to Central Receive Site

- 6425 MHz, 3.221 km path, FSPL = 118.81 dB
- TPO = 0.25 watt, G_{txant} = 6 dBi
- G_{rxant} = 36 dBi, 6 dB line loss
- RCL = -58.83 dBm
- C/(I+N) Margin: -56.77 – (-58.83) = 2.06 dB

Since the required C/(I+N) margin is 17 dB, the interference caused by a *single* Wi-Fi-type device creates a shortfall of about 15 dB and massive interference will occur to the ENG

[17] This example assumes an IMT Model 7A30SS transmit antenna with 30 dBi gain and a Newscaster VT7.4 transmitter with 30 dBm output power; and a Proscan 3 receive antenna with 36 dBi gain and 6 dB line loss.

link. In this scenario, the U-NII device would need to be over 11 miles away from the ENG receiver in order to eliminate the interference. The presence of multiple U-NII devices in the same path would obviously exacerbate the interference. We emphasize that this is not a worst-case analysis and it is common for ENG systems to operate much closer than 25 dB to the threshold sensitivity of the receiver. Because even relatively low-power, indoor operations of unlicensed devices in the U-NII-6 and U-NII-8 bands can cause interference to mobile outdoor BAS operations, the Commission certainly should not consider permitting high-power operations in these bands.[18]

Nor should the Commission assume that building shielding will protect licensed operations. While building penetration losses are a complex function of building material, arrival angle, relative location, frequency and other factors, common glass window panes installed ubiquitously throughout the United States offer practically no attenuation at 6 GHz.[19] While some building materials, including modern "low-e" window coatings, may offer greater signal attenuation, the assumed use of such materials is speculative at best.

Further, the ineffectiveness of building shielding has already been shown to be a ruinous problem in the 2.5 GHz bands, where BAS Channels 8 and 9 (2450-2467 and 2467-2483.5 MHz) overlap with or suffer from out-of-band emissions from Wi-Fi Channels 9 and 10 (2449.5-2454.5 and 2454.5-2459.5 MHz). The ubiquitous and uncoordinated use of these channels by unlicensed Wi-Fi devices, mostly used indoors, has rendered licensed operations at BAS Channels 8 and 9 practically impossible. There is no reason to believe that

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[18] NPRM at ¶ 74.

[19] Ängskog, P., Bäckström, M., Vallhagen, B., "Measurement of Radio Signal Propagation through Window Panes and Energy Saving Windows" *Proceedings of 2015 IEEE International Symposium on Electromagnetic Compatibility*, 74-79 (2015).

interference to similar BAS operations in the proposed U-NII-6 and U-NII-8 bands would be less likely to suffer interference from unlicensed operations within and near those bands.

B. Proposed Mechanisms for Restricting Unlicensed Operations Are Ineffective

Even if restricting unlicensed use in the U-NII-6 and U-NII-8 bands to low-power, indoor operation would protect licensed users, the Commission's proposals for ensuring that unlicensed operations only occur indoors are plainly inadequate. The NPRM proposes to ensure that unlicensed operations are confined to indoors by requiring that the devices have a "direct connection to a power outlet."[20] This proposal ignores the fact that outdoor power outlets are common in residential and commercial areas as well as public parks. It also fails to account for extension cords.

The proposal to measure GPS signal strength as a proxy for whether a device is indoors is similarly unreliable. GPS signals also penetrate through windows, and in real-world applications Wi-Fi devices may be intentionally placed next to windows to facilitate outdoor coverage. There simply is no easy way to ensure that unlicensed operations in the U-NII-6 and U-NII-8 bands are confined to indoor locations and, as discussed above, such a restriction will in any event not prevent harmful interference to licensed BAS operations.

C. Proposed Protections for the U-NII-5 and U-NII-7 Bands Will Not Translate to the U-NII-6 and U-NII-8 Bands

The NPRM seeks comment on whether an AFC system that would exclude unlicensed operations from certain areas, like the one proposed for the U-NII-5 and U-NII-7 bands, could be used to protect fixed operations in the U-NII-6 and U-NII-8 bands.[21] As an initial matter,

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[20] NPRM at ¶ 71.

[21] *Id.* at ¶ 75.

NAB agrees that exclusion zone calculations for an AFC system require detailed knowledge of the incumbent receiver location and antenna orientation.[22] Because these details are unknown for most BAS mobile operations, the AFC approach will fail to protect mobile BAS operations.

Further, the Commission recently authorized LPAS devices, including wireless microphones, in the U-NII-8 band. The Commission notes that "as of June 22, 2018, no Low Power Auxiliary Station licenses were listed in the [U-NII-8] band in ULS."[23] However, as a threshold matter, NAB notes that the final rules for use of this band by LPAS were not published until late 2017 – just over one year ago.[24] The Commission has forced wireless microphone operations to shift frequencies several times and manufacturers and their customers require a reasonable amount of time to develop equipment and strategies to accomplish those shifts. While there appears to be no commercial equipment currently available for LPAS use in that band, there are ultrawideband wireless microphone systems authorized across the entire 6 GHz spectrum, and experimental equipment has been tested and continues to be deployed under special temporary authority.[25]

Equipment manufacturers have also reported that additional LPAS operations and equipment in this band are planned as the market develops and is being driven by the

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[22] *Id.* at ¶ 61.

[23] NPRM at ¶ 10.

[24] *Promoting Spectrum Access for Wireless Microphone Operations*, Order on Reconsideration and Further Notice of Proposed Rulemaking, 32 FCC Rcd 6077.

[25] For example, the Alteros Incorporated UWB Wireless Microphone System, FCC ID 2AJX8GTX24HH. *See also* WH9XDO, issued to Broadcast Sports, Inc., for "testing of prototype wireless microphones which operate in the 6875-7125 MHz band at broadcast events."

increasingly constrained spectrum of the UHF television band. NAB expects that this band will become more important for broadcast operations as VHF and UHF broadcast spectrum becomes less viable for LPAS operations due to repacking of primary and secondary broadcast stations.[26] These LPAS systems would typically be deployed on a temporary basis. Therefore, the AFC system and other mitigation options proposed in the RKF study would not be feasible or adequate in the bands and locations where BAS mobile and LPAS operations are authorized.

While it is possible that the AFC framework could be adapted to protect permanent, fixed BAS links in the U-NII-6 and U-NII-8 bands, there are some fixed BAS paths where the Commission's ULS database does not provide receive end data, generally for three reasons. First, some BAS fixed paths were licensed prior to the existence of the ULS. Prior to 1981, the FCC's database required only the transmitting site parameters (coordinates, transmitting antenna elevation and main beam distance and bearing). When this legacy license data was imported into the ULS in 1999 the FCC dropped the distance information – leaving no ability to estimate the end point coordinates. Second, the receive-end data for some post-1981 TV BAS fixed-link records was lost when the link information was entered into ULS. Finally, in some cases the receive-end information is available in the ULS but is incorrect or out of date. This may be due to accuracy limitations when using paper 7.5-minute topographical maps, especially when the path involved a new site, with no landmarks on the topographic map to allow the coordinate determination to a precision of ±1 second of latitude and longitude.[27]

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[26] LPAS operations are restricted to 6875-6900 MHz and 7100-7125 MHz. 47 CFR §§ 74.802 and 74.831.

[27] See "Fixed Service Frequency Coordination in the BAS and Cable Television Relay Service Bands of 6875-7125 MHz and 12700-13150 MHz," National Spectrum Management

IV. THE COMMISSION SHOULD USE CAUTION IN ADOPTING TECHNICAL RULES FOR UNLICENSED OPERATIONS IN THE 6 GHZ BANDS

For the reasons described above, NAB believes unlicensed operations in the U-NII-6 and U-NII-8 bands will create an unacceptable risk of harmful interference to licensed BAS operations. The protections the Commission has proposed will not protect BAS operations and, in any case, are not enforceable. NAB provides additional information below in response to the NPRM's specific requests for technical input.

A. The Commission Should Use A Conservative Propagation Model

To the extent that any U-NII operation is ultimately permitted in the 6 GHz bands, NAB urges the Commission to use a free space propagation model to determine interference protection of fixed links, and not to assume clutter losses that attenuate the signals of unlicensed operations.[28]

The NPRM asserts that use of a free space model would "effectively assume worst case conditions for every link and likely overestimate the potential interference in most cases and unnecessarily restrict access to the spectrum for unlicensed use."[29] NAB respectfully disagrees. Especially for opportunistic BAS links, where a node may be installed on a building ledge or behind a window at fairly low height, the path loss for the desired signal increases from free space at short distances to much greater than free space beyond a breakpoint distance – with path loss exponents of four or greater being reported even when the optical

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Association Recommendation WG 03.17.001, available at: https://nsma.org/wp-content/uploads/2015/04/nsma-recommendation-wg0317001-fixed-service-frequency-coordination.pdf.

[28] NPRM at ¶ 49.

[29] *Id.* at ¶ 49.

path is clear. This high-path loss has been reported by many observers, and the distance to the breakpoint is often expressed as:

$$R_b = 4\frac{h_1 h_2}{\lambda}$$

where h1 and h2 are the receive and transmit antenna heights.[30] For example, at 6425 MHz for antenna heights of ten and two meters respectively, the breakpoint distance would be about 1.7 kilometers. Path lengths exceeding this distance are common for temporary fixed links used for coverage of parades and foot races. Therefore, even free space loss may not be adequate predictor of desired signal level in many cases. The incorporation of clutter assumptions or other factors to predict the level of the interfering signal reflects a misguided attempt to increase accuracy but will only likely result in increased incidents of interference.

NAB urges the Commission to use free-space path loss as the most reasonable estimator of signal levels, both desired and undesired, and to make appropriate statistical adjustments to account for signal variations, such as Rayleigh fading. In particular, NAB requests that the Commission not use the WINNER II or ITU-R P.2108 models some commenters recommend.[31] These models incorporate clutter losses and other factors based on databases that are unreliable and often too geographically coarse relative to the size of the necessary protection zone.

B. Additional Technical Considerations

The NPRM asks whether fixed BAS operations typically have the same design criteria regarding availability and fade margins as Private Operational Fixed public safety (POFS) and

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[30] H. Bertoni, *Radio Propagation for Modern Wireless Systems*, 28 (Upper Saddle River: Prentice Hall PTR, 2000).

[31] NPRM at ¶ 48.

business/industrial pool links.[32] While some permanent fixed BAS links have design criteria similar to POFS, this is typically only the case for links where long-term high reliability is paramount, such as studio-to-transmitter (STL) links and inter-city relays.[33] Temporary fixed links and mobile ENG operations typically are not engineered and often have extremely low fade margins, such as 6 dB or less. Similarly, if the Commission does choose to permit unlicensed operations in the U-NII-6 and U-NII-8 bands, NAB urges fixed-link protection based on noise-floor degradation (I/N protection) rather than on an assumed fade margin of the desired signal (C/I protection). An I/N criterion can help protect against Rayleigh fading, equipment degradation, changing atmospheric conditions and other considerations.

Additionally, if the Commission uses an AFC framework in any part of the 6 GHz band, it must take care to avoid the pitfalls of the Television White Space (TVWS) and Dynamic Frequency Selection (DFS) systems, both of which suffered from the lack of identification and authentication of users and locations as well as inadequate security. Specifically, we recommend that the Commission not allow "professional installation" as a means of verifying the accuracy of data. Data entry should require as little human intervention as possible and, if any user-entered or installer-entered parameters are permitted, the user or installer entering that information must be held responsible for its accuracy. The Commission could potentially enforce this requirement by issuing a unique authentication key, which can be revoked for cause.

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[32] *Id.* at ¶ 64.

[33] Hinckin, E., Rooney III, J., and Irwin, D., "STL Systems for Radio and TV," in *NAB Engineering Handbook 11th Edition* (ed. Garrison C. Cavell 2018).

NAB also recommends that the Commission require that unlicensed devices have a continuous or near-continuous connection to a certified database while transmitting. The Commission should establish rigorous qualification requirements for AFC operators and adhere to them.[34] Additionally, any database must be up-to-date and accurate with access available at no cost. Rapid and positive identification of unlicensed devices and authentication of their owners is essential to resolving interference. Indeed, based on the poor track record of prior unlicensed database coordination systems evidenced by flaws in the TV White Spaces database, the Commission should consider carefully whether any database approach should be used at all.

The use of a beacon or geofencing system to prohibit U-NII operations inside buildings or over small outdoor areas may have some utility in protecting some operations in the 6 GHz band. NAB emphasizes, however, such systems would likely be unable to block unlicensed device operations over a large enough area to protect long-distance ENG operations.

NAB also notes that the assumed use of antenna pointing restrictions on unlicensed devices in the U-NII-5 and U-NII-7 bands would be practically unenforceable.[35] Prior attempts by the FCC to discourage user attachment or modification of prohibited external antennas have proven ineffective.[36] It is also unreasonable to assume that users will not reorient or tilt their devices to improve coverage.

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[34] Petition for Reconsideration of the National Association of Broadcasters, ET Docket No. 04-186 (Oct. 19, 2018).

[35] NPRM at ¶¶ 57-59.

[36] *See OET Clarifies Antenna Connector Requirements for Part 15 Unlicensed Transmitters*, Public Notice, 15 FCC Rcd 10380 (2000).

The NPRM proposes to prohibit unlicensed operations in the 6 GHz band on moving or airborne access points.[37] NAB agrees that this restriction is prudent, particularly for airborne access points that could potentially cause interference over a large area. However, it is unclear how the Commission could enforce this prohibition without real-time and continuous GPS connectivity to verify a device's location and whether it was mobile. Accordingly, whether or not the Commission considers allowing mobile operation in the 6 GHz band, it should require GPS connectivity to ensure that an AFC system can function as intended.

Finally, the proposed out-of-band emission (OOBE) limitations for unlicensed operations in the 6 GHz bands do not appear to be adequate to prevent interference to users of adjacent spectrum. If indoor operations are permitted in the U-NII-5 and U-NII-7 bands, and OOBE levels are required to be 45 dB below the peak transmit power spectral density of the device, interference may result to nearby BAS receivers in the U-NII-6 and U-NII-8 bands. NAB is studying this issue but cautions that additional attenuation of OOBE may be necessary to protect adjacent-band users. Long-term, the Commission must ensure that OOBE in other bands does not lead to noise degradation in the U-NII-6 and U-NII-8 bands.

V. CONCLUSION

Broadcasters and other programmers make extensive and important use of the spectrum in the U-NII-6 and U-NII-8 bands to provide programming viewers enjoy today. Allowing unlicensed operations in these bands would cause harmful interference to those BAS operations, even with the protections the Commission proposes. The Commission's proposed restrictions – that unlicensed operations be low-power and indoor-only – are irrelevant to many BAS operations that are themselves low-power and indoors. Further, because many

[37] NPRM at ¶ 84.

fixed BAS links have high RF visibility and travel across significant distances, unlicensed operations near windows can easily disrupt communications. For these reasons, we urge the Commission not to permit unlicensed operations in the U-NII-6 and U-NII-8 bands in this proceeding. If a reasonable and reliable means of preventing interference develops, the Commission can consider unlicensed operations in these bands at a later date.

Respectfully submitted,

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